DAIRY RESEARCH

By Julio Giordano

Maximize insemination of lactating dairy cows in heat based on activity for second and subsequent AI services.

Maximize insemination of cows in heat

Maximizing the proportion of cows inseminated in heat is the goal of many dairy farmers. In particular, some farmers are interested in this strategy because they already use automated heat detection systems, such as activity monitors, or because they prefer to reduce their reliance on timed artificial insemination (TAI) programs.

Our research group recently concluded a study that evaluated the impact on cow reproduction of a management program aimed to maximize the proportion of cows inseminated in heat after they fail to conceive during previous AI services. Also, we aimed to maximize the fertility of cows that received TAI after not being inseminated in heat despite ample time and multiple opportunities to express estrus.

Our objective was to evaluate if the treatment strategy would maximize the proportion of cows inseminated in heat based on estrous activity, as determined by an automated activity monitoring system (AAM), and thereby reduce reliance on TAI programs, and time to pregnancy during lactation.

Cows from a commercial dairy farm in NY were enrolled in our treatment group (TRT; n = 616) to be inseminated if detected in heat by an automated activity monitoring system any time after a previous AI. If cows were not inseminated by the time of nonpregnancy diagnosis (NPD) 32 days (d) after AI they were enrolled in two different reproduction protocols based on whether or not a corpus luteum (CL) was present on their ovaries (Figure 1).

Cows with a CL (TRT-CL) received a PGF (prostaglandin F2 alpha) injection to cause CL regression, and induce estrus. As a consequence, cows would have another opportunity to be inseminated in estrus. If not inseminated after nine days they were enrolled in a five d-Ovsynch protocol with progesterone (P4) supplementation to receive their next TAI service.

Cows without a CL (TRT-NoCL) were allowed to be detected in estrus for two days after enrollment and received a GnRH (gonadotropin releasing hormone) injection for presynchronization of the estrous cycle. If not detected in estrus for the next seven days they were enrolled in the same TAI protocol as cows in the TRT-CL group (Figure 1).

For cows not detected in heat we chose to use presynchronization of the estrous cycle with PGF or GnRH and a more complex protocol than Ovsynch for TAI to optimize fertility of these cows that for unknown reasons failed to be detected in heat.

Based on the assumption that most cows would be enrolled in the TRT-CL group and receive AI after heat detection we anticipated that very few cows would need synchronization and TAI. The rather complex repro program for the TRT group was compared to a very simple and typical strategy (CON group; n = 634) used by dairy farms which combines heat detection and resynchronization for TAI with the Ovsynch protocol (also known as Resynch).

The results of this study supported our hypothesis that the proportion of cows inseminated in heat could be maximized. The additional percentage of cows inseminated in heat was below our expectations with only ~20% more cows receiving insemination in heat in the TRT than in the CON group. Having only 65% of the cows meet the criterion for inclusion in the TRT-CL group (have a CL) certainly contributed to the low percentage of cows inseminated in heat. This is not surprising for nonpregnant previously insemi-

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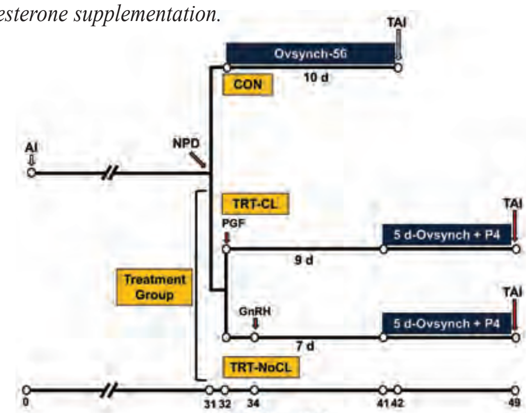
Figure 1. *Schematic representation of experimental procedures. NPD = nonpregnancy diagnosis, CON = control group, TRT-CL = treatment corpus luteum (CL) group, TRT-NoCL = treatment no corpus luteum group, P4 = progesterone supplementation.*



FYI

■ **Julio Giordano** is Assistant Professor of Dairy Cattle Biology and Management in the Department of Animal Science at Cornell University

veterinarian and cost approximately $2 a test. The test requires only a couple of drops of blood, most easily taken from tail vessels.

Two types of measurements can estimate the amount of hyperketonemia in a herd: incidence or prevalence. Incidence refers to new cases and requires repeated testing of a set of animals to see if they develop hyperketonemia. Previous studies by researchers at Cornell and the University of Wisconsin show that the incidence of hyperketonemia can be estimated in a herd by testing animals at least twice a week from three to 16 days in milk. For example, a herd could choose to follow 50 fresh cows and test them each twice a week for their first two weeks of lactation, to see how many develop hyperketonemia. The incidence is then calculated by the number of cows that test positive for hyperketonemia at least once, divided by the total number of cows tested. In this example, if 20 cows tested positive (blood BHBA ≥1.2 mmol/L) at least once, the herd incidence is 40% (20/50).

Prevalence refers to the number of new and existing cases and requires just one test of a set of animals. Studies from the University of Guelph and Cornell show that the incidence of hyperketonemia is approximately twice the prevalence. For example, a herd could choose to test 50 animals at one time that are between three and 16 days in milk. If 10 of those animals were hyperketonemic, the prevalence of hyperketonemia would be 20% (10/50). The incidence of hyperketonemia in the herd could then be estimated at 40% (2 x 20%).

As for most diseases, the goal of any testing and treatment or management strategy for hyperketonemia is to optimize the economic return while improving the health and well-being of dairy cows. Given the potentially large negative financial impact of hyperketonemia, the return on investment in sound treatment of cows and management of the herd is likely to be positive. ❐

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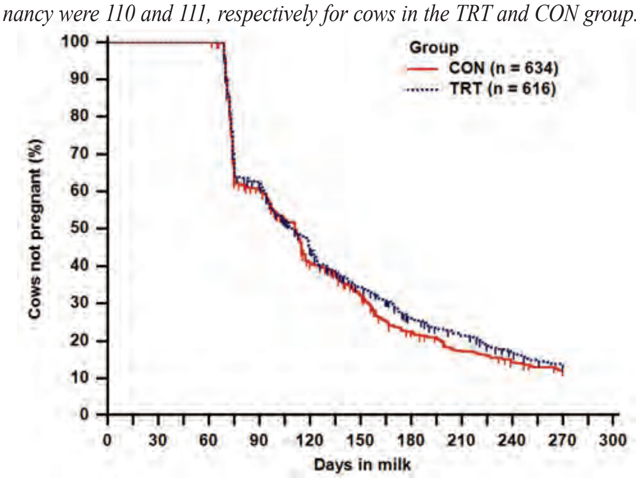
around 30 d after AI. More surprisingly was that only 38% of cows with a CL and that received PGF were inseminated in estrus because we carefully selected cows that should be responsive to the treatment.

We expected to detect at least 50% or more cows in estrus. It is unlikely that the method of estrus detection in the present study was responsible for the poor heat detection efficiency. The AAM system used in this study monitored cows continuously (24 h per day, 7 d per week) and used individual cow baseline data to trigger a heat event. Indeed, during the study period ~50% of the cows eligible to be inseminated before NPD were detected with increased activity by the AAM system. Although it cannot be ruled out that the AAM system failed to detect increased activity in some cows, at the moment we speculate that lack of estrus expression, rather than limitations to detect estrus resulted in poor heat detection after the PGF treatment.

Because the objective of any dairy farm is to get cows pregnant at the appropriate time in their lactation, the rate or speed at which cows became pregnant in our study was the most relevant outcome. We observed no statistical difference (P-value = 0.28) in the rate at which cows became pregnant up to 270 DIM (Figure 2). Median days to pregnancy which indicate the time when 50% of the cows become pregnant were 110 and 111 DIM for cows in the TRT and CON group, respectively.

Thus, the results of the present study support our hypothesis that more cows can be inseminated in heat after NPD, but does not support the hypothesis that the more complex TRT strategy would be superior to the simple and widely adopted one used for cows in the CON group. The relatively low proportion of cows with a CL at NPD and the poor heat expression of cows after the PGF injection contributed to the lack of difference between groups. Any potential benefit of inseminating cows in heat immediately after NPD in the TRT group was negated by the low proportion of cows that displayed estrus. Our results suggest that for a strategy aimed to maximize AI after heat detection, coupled with a delay to the beginning of the TAI protocol, the minimum proportion of cows to inseminate in heat to avoid detriment to the herd reproductive performance is ~30%. Our results also underscore the importance of immediately enrolling cows not AI in heat into a TAI program.

Figure 2. *Survival analysis for time to pregancy during lactation. The rate at which cows became pregnant during lactation was similar (P-value = 0.28) for cows in the Treatment (TRT) and Control (COM) group. Median says to pregnancy were 110 and 111, respectively for cows in the TRT and CON group.*



What this means to dairy producers is that they have the option to select a more aggressive resynchronization program that assures reinsemination of cows within 10 d of NPD but does not favor heat detection as in our control group. Or, they can adopt a strategy that maximizes insemination of cows in heat as in our treatment group.

It is imperative, however, to have in place a synchronization of ovulation protocol to submit cows to TAI immediately after the completion of the heat detection period. This is more relevant for dairy farms that due to biological limitations from the lactating dairy cow or the myriad of environmental and management factors that affect heat expression and detection cannot detect a high percentage of cows in heat after NPD. It is uncertain at the moment whether the use of a more complex, labor intensive and costly protocol such as the 5d-Ovsynch+P4 (requires two PGF injections and a P4 releasing device) protocol and presynchronization is necessary to maximize the fertility of cows not inseminated in estrus or not presenting a CL at the time of NPD. ❐